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PATENT & TRADEMARK OFFICE

Patent
Attorney's Docket No. 1016660-000177

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of
Cheung Hoi Yu et al.
Application No.: 10/686,252
Filed: October 16, 2003
For: APPARATUS AND METHODS FOR DETECTING NUCLEIC ACID IN BIOLOGICAL SAMPLES

MAIL STOP AMENDMENT
Group Art Unit: 1637
Examiner: David C Thomas
Confirmation No.: 7612

REPLY PURSUANT TO 37 C.F.R. § 1.112

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated December 12, 2006, reexamination and further and favorable reconsideration of the subject application in light of the following remarks, pursuant to and consistent with 37 C.F.R. § 1.112, are respectfully requested.

Applicants' undersigned representative thanks the Examiner for the courtesy of a personal interview on March 28, 2007 at the United States Patent and Trademark Office. As set forth in the Interview Summary provided by the Examiner, Applicants' representative explained key differences between the claimed invention and the cited art. Below, the substance of what was discussed is presented in writing and elaborated in greater detail.

Claims 13-24 and 27-34 stand rejected under 35 U.S.C. § 102 as allegedly anticipated by U.S. Patent Number 5,605,662 ("Heller").

The rejection is respectfully traversed. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Here, the claims are directed to methods so that every element of the claimed methods, including the recited features of the device and manner in which the combination of steps are carried out must be disclosed in the cited art in order to support the rejection.

Applicants previously pointed out that the prior art does not disclose all the elements of steps of the claimed methods. Heller does not teach the combination of a dielectric material defining an attachment surface, a metal electrode in direct contact with said dielectric attachment layer and attaching nucleic acid capture probes to said dielectric attachment layer, wherein the dielectric layer is structured so as to permit providing an electrical potential to the electrode without generating a flow of electric current as required by the claimed methods. Furthermore, Heller does not teach or suggest "providing an electrical potential to said metal electrode causing charge separation in said dielectric attachment layer but without generating a flow of electric current or causing transfer of electrons between said layer and the sample" or "generating an electrical field by inducing charge-separation in said dielectric layer but without generating a flow of electric current or causing transfer of electrons between said dielectric layer and the sample" as recited in the claims. There are additional distinctions, which Applicants have already pointed out, but the following remarks will focus on these issues for the sake of brevity.

In maintaining this rejection, the Office has alleged that what is labeled as a metal oxide layer in the devices disclosed in Heller would inherently have the properties of the dielectric attachment layer recited in the claims, and that the method of using such devices would inherently anticipate the presently claimed methods.

However, the Office has not made out a sufficient showing of inherency to support the rejection. While a metal oxide layer can be constructed to be a dielectric layer, it is not a necessarily inherent property. Heller used an APS reaction to attach DNA to metal oxide on an electrode and then applied a 0.05 mA current through the electrode. Heller at col. 26, ll. 15-59. Heller's own example shows that metal oxide on a metal electrode does not necessarily function as a layer of dielectric material blocking electric current.

The mere possibility that a metal oxide layer could be constructed to function as a dielectric is not sufficient to support the present rejection. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993); *In re Oelrich*, 666 F.2d 578, 581-82, 212 U.S.P.Q. 323, 326 (CCPA 1981). The law is quite clear on this point. "**To establish inherency**, the extrinsic evidence must make clear that the missing descriptive matter is **necessarily present** in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. **Inherency, however, may not be established by probabilities or possibilities**. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2d 1949, 1950-51 (Fed. Cir. 1999) (emphasis add, internal quotations and citations omitted).

In fact, the disclosure of Heller itself quite clearly demonstrates that the properties that the Office has ascribed to the Heller device **cannot** be inherent in the Heller device and that the methods of using the Heller device must be distinct from the presently claimed methods.

Heller discloses that the device operates by free field electrophoretic propulsion. Heller at col. 5, ll. 45-49, col. 11, ll. 54-57. Direct current flow of charge is required for the operation of free field electrophoresis. Heller at col. 11, ll. 23-39. With regard to the attachment layer, Heller teaches that "the most important aspect of the invention . . . crucial for the active functioning device" is that "the attachment of specific binding entities must not overcoat or insulate the surface so as to prevent the underlying micro-electrode from functioning." Heller at col. 13, ll. 32-41 (emphasis added). According to Heller, the metal oxide layer and the attachment layer must not insulate the electrode. Therefore, the metal oxide layer and attachment layer of the Heller device cannot function as an insulating dielectric layer.

Heller explicitly states that "A functional device requires some fraction (-5% to 25%) of the actual metal micro-electrode surface to remain accessible to solvent (H_2O) molecules, and to allow the diffusion of counter-ions (e.g., Na^+ and Cl^-) and electrolysis gases (e.g., O_2 and H_2) to occur." Heller at col. 13, ll. 41-46. That is, Heller's disclosed method of using the Heller device requires that some of the actual metal micro-electrode surface remain exposed so as to provide for a closed circuit and the flow of current.

Heller goes on to teach that: "After the device is addressed with specific DNA sequences, the micro-locations on the array device remain as independent working direct current (DC) electrodes. This is possible because the attachment to the electrode surface is carried out in such a manner that the underlying micro-electrode does not become chemically or physically insulated. Each micro-electrode can still produce the strong direct currents necessary for the free field electrophoretic transport of other charged DNA molecules to and from the micro-location surface" Heller at col. 18, lines 10-19. In actual use, Heller describes running the device at constant current measured in Amps. Heller at col. 24, lines 15-67; col. 29, ll. 19-20. To be measured in Amps necessarily means a flow of electric current.

In fact, the requirement by Heller that the device electrodes cannot be insulated absolutely excludes the possibility that the Heller device could be used in a method comprising "providing an electrical potential to said metal electrode causing charge separation in said dielectric attachment layer but without generating a flow of electric current or causing transfer of electrons between said layer and the sample" or "generating an electrical field by inducing charge-separation in said dielectric layer but without generating a flow of electric current or causing transfer of electrons between said dielectric layer and the sample" as recited in the claims.

At page 15 of the Office Action, the Examiner has suggested that the description at page 7, line 23 to page 8, line 13 of the Specification appears to need a flow of electrons. The Examiner has asserted that there is no explanation of what would prevent this flow of electrons from continuing into the probe and sample layers. Applicants respectfully submit that these remarks evidence a misapprehension of the principles of electrical circuits and electrostatic potentials that would be understood by a person of ordinary skill in the art of making devices such as disclosed in the present application. (It must also be noted that the Office has not alleged that one of ordinary skill in the art would not understand the claims or be able to practice the claimed invention.)

A person of ordinary skill in the art would understand that a dielectric, or electrical insulator, is a substance that is highly resistant to the flow of an electric current. When a dielectric medium interacts with an applied electric field, charges are redistributed within its atoms or molecules. This redistribution alters the shape of an applied electrical field both inside the dielectric medium and in the region nearby. *See, e.g.* http://en.wikipedia.org/wiki/Dielectric.

When a potential (i.e. voltage) is applied to the electrode as illustrated in Figure 3, no substantial current flows between the electrode and the sample, or between the dielectric and the sample. A charge separation occurs across the dielectric, which is the establishment of a dielectric polarization affect. The rearrangement of charge inside the dielectric is sometimes called a displacement current and appears to be what the Examiner is referring to in his remarks. However, the "displacement current" is not a current in the conventional sense of transfer of electrons through a circuit, but reflects the elastic polarization of atoms and molecules in the dielectric material, as would be appreciated by the skilled practitioner. The sum of these atomic and molecular polarizations produces an electric field and apparent separation of charge. A person of ordinary skill in the art would recognize this as being analogous to what happens when an electric potential is applied to the opposed electrodes of a capacitor.

This polarization of the dielectric material results in the creation of an electromagnetic force field that extends into the sample and that can attract or repel charged particles. By contrast to Heller, the effect occurs without any transfer of electrons, thereby avoiding undesired electrolysis and other electrochemical reactions.

For at least the foregoing reasons, Heller fails to anticipate the claimed invention even inherently. In fact, the teachings of Heller are in direct opposition to the present invention. Therefore, withdrawal of the rejection is appropriate and is respectfully requested.

Claims 13-24 and 27-34 have been rejected under 35 U.S.C. § 102(e) as allegedly anticipated by U.S. Patent Application Publication 2004/0033496 (Yu). This rejection is also traversed.

Yu discloses a device for detecting target DNA comprising an aluminum electrode and an aluminum oxide attachment layer. The Office has alleged that the aluminum oxide is a dielectric material defining an attachment surface. However, while aluminum oxide can function as a dielectric material, a layer of aluminum oxide on an aluminum electrode does not necessarily comprise a layer of dielectric material sufficient to insulate the electrode as may be seen from Heller as discussed above. Therefore, the use of such a device would not inherently comprise "providing an electrical potential to said metal electrode causing charge separation in said dielectric attachment layer but without generating a flow of electric current or causing transfer of electrons between said layer and the sample" as required by the present claims.

The disclosure of Yu itself proves that the alleged inherent properties of aluminum oxide are not sufficient under the law to support the rejection. Indeed, the device is described in Yu as being used by applying 13 microamp pulses (microamps being a measure of current) in 10 second pulses, though continuously applied current is also possible. Yu at paragraph [0043]; see also claims 32 and 33. To support a rejection based upon inherency, the alleged inherent property must be a necessary result of the disclosure, which is clearly not the case here.

Yu does not teach or suggest a method comprising "providing an electrical potential to said metal electrode causing charge separation in said dielectric attachment layer but without generating a flow of electric current or causing transfer of electrons between said layer and the sample" or "generating an electrical field by inducing charge-separation in said dielectric layer but without generating a flow of electric current or causing transfer of electrons between said dielectric layer and the sample" as recited in the claims.

Accordingly, withdrawal of the rejection is appropriate and is respectfully requested.

CONCLUSION

In view of the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order. Such action is earnestly solicited.

In the event that there are any questions relating to this application, it would be appreciated if the Examiner would telephone the undersigned concerning such questions so that prosecution of this application may be expedited.

The Director is hereby authorized to charge any appropriate fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

Respectfully submitted,

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